SATURN'S RINGS.—In the last (January) number of the "Monthly Notices of the Royal Astronomical Society" are reproduced some old drawings of Saturn, given in the edition of Gassendi's works published at Lyons, in six volumes, in 1658 (Lalande, *Bibliographie Astronomique*, p. 245).

In the volume entitled *De Annulo Saturni*, by E. M. Beima (Augsburg, 1842), a work less known in this country than it deserves to be, will be found other reproductions of the earlier drawings illustrating the appearances which the planet was thought to present in the imperfect telescopes of the time. As a pretty complete monograph up to the date of publication, involving an exposition of the formulæ required in calculating the various phases of the rings, &c., Beima's treatise will be found a very desirable addition to an astronomical library.

THE MINOR PLANET, HILDA (No. 153).—In Herr Kühnert's last orbit of this planet, the aphelion distance is found to be 4·595, and the heliocentric latitude in aphelion, − 6° 33′, the longitude at this point being 105° 1′·6; hence, the least distance of the planet from the orbit of Jupiter is reduced to 0·564 of the earth's mean distance from the sun. So near an approach might afford an excellent opportunity of determining the value of Jupiter's mass, but if the period of revolution assigned by Kühnert upon eight-weeks' observations is at all approximate, such opportunity will not occur for many years to come. There may be a difficulty in recovering this planet at the next opposition, which is likely to take place near the aphelion, and when its faintness, owing to great distance from the earth, will be considerable; it is the more desirable, therefore, that observations should be obtained in the next period of absence of moonlight, that the mean motion may be fairly determined this season; the Ephemeris published in No. 2,075 of the *Astronomische Nachrichten* should render the identification of the planet a matter of no great difficulty in instruments of adequate aperture.

From the *résumé* of observations in No. 42 of the Circulars of the *Berliner Astronomische Jahrbuch*, it appears that No. 149 may get adrift, unless an observation on Nov. 2 can be proved to belong to it, and No. 155, as already remarked, is in even worse position.

THE TOTAL SOLAR ECLIPSE OF 1706, MAY 11–12.—Calculating upon the same system as employed for the solar eclipses to which reference has already been made in this column, the following elements result for the eclipse of May 1706, extensively observed in France, &c.

| | | |
|---|---|---|
| Conjunction in R.A. 1706, May 11, 21h. 59m. 26s. G.M.T. | | |
| R.A. ... ... ... ... ... | 48° 40′ 27″ | |
| Moon's hourly motion in R.A. ... ... | 36 49 | |
| Sun's ,, ,, ,, ... ... | 2 50 | |
| Moon's declination ... ... ... | 18 42 52 | N. |
| Sun's ,, ... ... ... | 18 4 0 | N. |
| Moon's hourly motion in decl. ... ... | 13 9 | N. |
| Sun's ,, ,, ,, ... ... | 0 36 | N. |
| Moon's horizontal parallax ... ... | 60 35 | |
| Sun's ,, ,, ... ... | 9 | |
| Moon's true semi-diameter ... ... | 16 31 | |
| Sun's ,, ,, ... ... | 15 49 | |

The following are points upon the central track of the shadow:—

| Long. | Lat. | | Long. | Lat. |
|---|---|---|---|---|
| 5° 40′ W. | 34° 39′ N. | ... | 16° 32′ E. | 52° 23′ N. |
| 1 4 E. | 40 40 | ... | 20 2 E. | 54 20 N. |
| 4 18 | 43 29 | ... | Central at Apparent Noon in Long. 29° 7′ E. Lat. 58° 18′ N. | |
| 7 37 | 46 12 N. | ... | | |

For examining the circumstances of the eclipse in the South of France, where the totality was witnessed, we have the following reduction equations founded upon a direct calculation for Avignon:—

Cos. $w = 41'1909 - [1'72518] \sin. l + [1'59372] \cos. l, \cos. (L - 103° 46'3)$
$t = 21h. 26m. 5'8s. \mp [2'08389] \sin. w + [3'60351] \sin. l$
$- [3'84024] \cos. l, \cos. (L + 38° 1'4).$

In these equations $L$ is the longitude from Greenwich reckoned *positive* to the *eastward*, $l$ the geocentric latitude, and $t$ the *Greenwich* mean time of beginning or ending of totality, according as the upper or lower sign is used.

## *PROF. FLOWER'S HUNTERIAN LECTURES ON THE RELATION OF EXTINCT TO EXISTING MAMMALIA*[1]

### I.

IF no certain *consensus* has yet been arrived at as to what palæontology teaches in reference to the derivative hypothesis, the chief reason is our very imperfect knowledge of palæontology, arising partly from the necessary imperfection of the geological record caused by the very small chance of the remains of any creature living upon the earth being preserved in a perfect state; partly from the very minute portion of the record which is actually preserved in the rocks having as yet been rendered accessible to investigation; partly from the defective knowledge of the structure and relationship of those documents, so to speak, which have already been brought to light, and of their existing representatives. The first cause must always remain a stumbling-block to these investigations. The second is gradually being removed by fresh explorations in many parts of the world, notably those now carried on with so much energy and success in North America. The third is one which only needs more numerous and more earnest workers to remove, and especially those who have the power and will to see the continuity of the manifestation of life upon the earth, and will abandon the old practice of studying the fauna of a particular epoch apart from that which preceded or succeeded it, and especially that of studying extinct forms without a thorough mastery of the key to the solution of the difficulties of their structure afforded by the more accessible existing species. Palæontology is no science apart—it can scarcely even be called a branch of zoology; it is simply the application of that science to elucidating the structure of beings now extinct. The thoroughly unscientific and mischievous system of arrangement of nearly all our great public museums, both at home and abroad, where two distinct collections are kept up, under distinct custodians—one for animals existing at the present moment upon the earth, and the other for animals that have existed at all other periods put together—has much to answer for in impeding the progress of sound zoological knowledge. Granted that our information is of a very limited nature, it still seems worth while occasionally to gather together the fragments of which it consists; and as it would be impossible in the time allotted to this course to do justice to more than a limited portion of the whole animal kingdom, it is proposed to take the class of mammals, as in many ways well suited for testing whether such facts as are known of their ancient history throw any light upon their mode of origin, and to point out, with impartiality, the results of the investigation. The poverty of the materials in some quarters, as well as their abundance in others, will thus be made manifest, and some useful landmarks afforded which may direct and stimulate future research.

As far as we know of the existing fauna of the world, and we can hardly suppose that in this respect our knowledge is not final, the Mammalia constitute a clearly defined group or class of the Vertebrata. Though covering a wide range of variety in structure, scarcely any zoologist has ever had any hesitation in defining its limits. There are, however, certain forms decidedly aberrant, and which in many of the characters in which they deviate from the ordinary standard of the class, approximate to the lower groups of vertebrates. The most marked examples of

[1] Abstract of a course of lectures delivered at the Royal College of Surgeons "On the Relation of Extinct to Existing Mammalia, with Special Reference to the Derivative Hypothesis," in conclusion of the course of 1873. (See Reports in NATURE for that year.)

this condition are seen in the Marsupials, and in a still higher degree in the small order of Monotremes. These present a marked approach to the *Sauropsida*, or reptile and bird group. Such semi-transitional forms, as they may be called, furnish valuable indications of the route by which the higher types might have been brought about, and appear, upon the evolutionary hypothesis, to be unmodified survivors of a condition which was only transitory in the large bulk of the class. Their value as evidence for gradual development would be greatly strengthened if corroborated by palæontology. Beyond them nothing is known in the present condition of life of any truly intermediate forms between the Mammalia and the other class of vertebrates, and the same must be said, as far as we know at present, of all former ages. The line which we now draw round the class to separate it from all others will include within its limits all hitherto discovered mammalian remains. No forms more transitional, or approaching nearer to any other class, or even, as we shall see, so near as do the Monotremes, occur in the records of palæontology. Of course our evidence on the subject is only negative, and as such has little real value. The first appearance, of which we are at present informed, of mammals upon the earth, was early in the Mesozoic period, in the epoch called Triassic. At that time the other classes of Vertebrata, except, perhaps, birds (but our evidence here is defective), had long been well established and distinctly defined. Indications of mammalian life occur in various formations, at different ages, and at scattered points upon the earth's surface, throughout the Mesozoic ages, but during its later stages are entirely lost. These indications, though very fragmentary, all show animals of minute proportions, and for the class to which they belong, rather low organisation. With the commencement of the Tertiary period, however, a total change takes place. Wherever the great Cretaceous ocean bottoms have been elevated so as to become the fit habitation of terrestrial animals, there mammals of varied size, form, and function have been found to dwell, and have left their remains, and from henceforth to the present time there is abundance of evidence of their continuous occupation of the earth's surface. The total absence of all marine mammals in the Cretaceous epoch, the fauna of which is, on the whole, so well preserved, and the absence of land mammals in the Wealden, are facts, which though difficult to account for, must not be overlooked.

Before proceeding to the consideration of the history of the special groups of Mammalia, attention may be called to a few points of general interest relating to the whole class, in which palæontological researches appear to have shown some evidence of gradual modification or progression as time advanced. The first is a small point, as it relates only to one family of animals, but it affords a good illustration of the parallelism which has been observed between the development of the race and that of the individual. The earliest known forms of deer, those of the Lower Miocene, as remarked by Gaudry, have no antlers, as the young of the existing species. The deer of the Middle Miocene have simple antlers, with not more than two branches, as in existing deer in the second year. In the Upper Miocene, species occur with three branches to the antlers, but it is not until the Upper Pliocene and Pleistocene times, that deer occur with antlers developed with that luxuriance of growth and beauty of form, characteristic of some of the existing species in the perfectly adult state. Next, the teeth in the greater number of Eocene mammals, both herbivorous and carnivorous, were of a much more generalised character than at present, and, as shown by Owen, commonly presented the full typical number of three incisors, one canine, four pre-molars, and three molars in each side of each jaw, making forty-four in all, a number found only in two genera at present existing. These teeth, moreover, in many species were more uniform in character and regularly placed, without intervals, in the jaws than in most of the later forms. They were also usually very short-crowned, and many cases can be traced of a successive lengthening of the crowns of the molars, and consequent greater provision for the wear of the organ, in a closely allied series of animals passing through successive geological epochs. Lastly, as remarked first by Lartet, and subsequently by Marsh, there has been in many groups a gradual increase of the size of the brain, as ascertained by the capacity of the interior of the cranium. Most of the Eocene mammals had very small brains in proportion to their size; this is well exemplified in the earliest known European Eocene carnivorous mammal, *Arctocyon primævus*, and still more strikingly in the huge American *Dinocerata*, animals nearly as large as the existing elephants, but whose brain cavity more resembles that of a reptile, being not more than one-eighth the capacity of that of a rhinoceros. The Miocene mammals of the same country had better developed brains, but even in the Pliocene Mastodons they did not equal the existing Proboscidea. A similar progression of brain capacity has been observed among deer, among the tapiroid Ungulates, and in a very well marked manner among equine mammals, especially from the Eocene *Orohippus*, through *Miohippus* and *Anchitherium* of the Miocene, *Pliohippus* and *Hipparion* of the Pliocene, to the recent *Equus*.

(*To be continued.*)

## *MADAGASCAR*[1]

AS most probably many of our readers know, a wealthy Parisian, M. Alfred Grandidier, who is thoroughly acquainted with Madagascar in all its aspects, has undertaken a mighty work on the physical, natural, and political history of the island, which is to form, when completed, twenty-eight volumes in large quarto, profusely illustrated with coloured plates. Six volumes, three of text and three of plates, are to be devoted to the Mammals, the first of each of these being those under notice on the present occasion. They, together with the Birds, in three volumes, and the Crustacea, are under the editorship of M. Alph. Milne-Edwards. The Fishes are undertaken by Dr. Sauvage; the Reptiles by M. Grandidier; the Insects by MM. Kunckel d'Herculais, Lucas, Oustalet, De Saussure; the Annelids by M. L. Vaillant, and the Mollusca by MM. Fisher and Crosse.

In the volumes before us there are 122 plates devoted to the anatomy of the Lemurian family *Indrisinæ*. *Propithecus diadema*, *P. edwardsii*, *P. verreauxii*, *P. deckenii*, *P. coquerelii*, *P. coronatus*, *Avahis* (*Microrhynchus*) *laniger*, *Indris brevicaudatus* are the species figured. Of these plates, thirty-nine refer to their osteology, more than twenty to their myology, forty to their visceral anatomy, thirteen to their external form, and twelve (as photographs) to the configuration of the feet. Most of these plates are exquisitely coloured, and all are beautifully drawn; the livers being the only organs with which we have any fault to find. The volume of letterpress only extends as far as the myology, the account of the viscera not having yet appeared. It is to do so in March next. From the drawings alone many particularly instructive facts may be learnt. The colic caecum of *Propithecus* is seen to be comparatively short and capacious, at the same time that the helix formed by the convolutions of the colon itself is as considerable as in any ruminant animal. In *Avahis* the helix is much less developed, whilst the caecum is longer. In *Indris* the caecum is enormously long, not being wide, the colic coil not forming a helix, but being disposed in parallel

[1] "Histoire Physique, Naturelle et Politique de Madagascar." Publiée par Alfred Grandidier. "Histoire Naturelle des Mammifères." Par MM. Alph. Milne-Edwards et A. Grandidier. Vol. VI. (texte) et Vol. IX. (atlas). (Paris: Imprimerie Nationale, 1875.)